REMARKS

Claims 1-7 were pending in this application. By way of this amendment and reply to the Office Action dated October 3, 2001, claim 4 has been amended, and new claims 8-10 have been added. Therefore, claims 1-10 are presently pending for consideration.

Applicants appreciate the indication of allowability made in the Office Action with respect to claims 5 and 6.

In the Office Action, the drawings were objected to for the reasons set forth in numbered sections 1, 2 and 3 of the Office Action. The specification and the drawings have been amended in accordance with these sections of the Office Action. Please note that Figure 7 shows the "deformable sheet" feature of claim 7, and the specification has been amended to clarify this and to refer to the proper figure in this regard.

In the Office Action, the title was objected to as not being descriptive. A new, more descriptive title is provided herewith.

In the Office Action, the disclosure was objected to for the reasons set forth in numbered section 5 of the Office Action. The specification has been amended in accordance with the comments made in numbered section 5 of the Office Action. Also, the specification has been amended in other places as well, to enhance readability. No new matter has been added.

In the Office Action, claim 4 was rejected under 35 U.S.C. § 112, second paragraph, for the reasons set forth in numbered section 7 of the Office Action. Claim 7 has been amended to overcome this rejection.

In the Office Action, claim 1 was rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,046,835 to Yamawaki et al.; claims 2-4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamawaki et al. in view of U.S. Patent No. 6,091,533 to Iizuka; and claim 7 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamawaki et al. in view of U.S. Patent No. 6,165,392 to Kobuchi et al. These rejections are traversed for at least the reasons given below.

Yamawaki et al. discloses a cylinder lens 22b having negative power. However, Yamawaki et al. does not disclose or suggest that the radius of curvature varies in a first direction (sub-scanning direction), as recited in claim 1.

In the present invention according to claim 1, the radius of curvature is set to vary in accordance with the location in the sub-scanning direction, to thereby reduce the RMS OPD at the image surface and p-v of the OPD. Yamawaki et al. does not disclose a resin lens having a radius of curvature varying in accordance with the location in the sub-scanning direction. It is also noted that Yamawaki et al. does not disclose the improvement of the RMS OPD. Thus, claim 1 should be patentable over Yamawaki.

In Iizuka, the post deflecting optical system is a mirror, and the material of the toric lens of the pre-deflecting optical system is not defined. It is unclear whether such a structure improves image-forming characteristics, and how it is influenced by a temperature raise. Needless to say, even if Iizuka is combined with Yamawaki et al., the present invention as recited in claims 2-4 differs from such a combination.

In the present invention as recited in claim 4, a resin lens to which appropriate power is given in the second direction (main scanning direction) is provided in the second lens. As a result, the movement of the image forming surface in the main scanning direction which occurs due to the change in the humidity and temperature in that resin lens in the post deflecting optical system, whose refractive index and shape easily vary due to the change in temperature and humidity, can be canceled by the advantage of the resin lens of the second lens, whose refractive index and shape easily vary due to the change in temperature and humidity.

With respect to claim 7, Kobuchi et al., as taught in column 8, lines 30 to 38, discloses the cross section of a lens manufacturing apparatus which has a concave mold part 8 and a convex mold part 9. The concave mold part 8 has a concave molding surface 8a, and the convex mold part 9 has a convex molding surface 9a. A cavity 10 is provided between the concave molding surface 8a of the concave mold part 8 and the convex molding surface 9a of the convex mold part 9. That is, in Kobuchi et al., only the portion corresponding to the cavity 10 is used as the lens surface. See column 6, lines 31-36 of Kobuchi. Kobuchi et al. does not teach or suggest a structure in

which two lenses are joined together, with a deformable sheet interposed therebetween. As such, claim 7 is patentable over the combined teachings of Yamawaki et al. and Kobuchi.

New claims 8-10 have been added, which are also believed to patentably distinguish over the cited art of record. For example, new claim 8 recites, inter alia, that the second lens includes a resin lens with a surface whose radius of curvature along a second direction is varied along a first direction. New claim 9 recites, inter alia, that a resin lens of a second lens has a surface whose radius of curvature in a first direction is varied along a second direction. New claim 10 recites, inter alia, that a resin lens of a second lens has a surface whose radius of curvature in a second direction is varied along the second direction. These features are not taught or suggested by the Yamawaki, Iizuka, or Kobuchi references.

Therefore, for the reasons stated above, Applicants believe that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

Respectfully submitted,

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Date

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Marked up replacement paragraphs:

SPECIFICATION

On page 9, 2nd full paragraph (lines 8-11):

FIG. 5 is a schematic view showing one example of [a hybrid lens structure through which arbitrary beam of] one of hybrid lens structures through which laser beams of the forwardly deflecting optical system of the optical scanning device shown in FIG. 2 [passes] pass;

On page 9, 3rd full paragraph (lines 12-15):

FIG. 6 is a schematic view for explaining [a first embodiment of the hybrid lens through which arbitrary beam] one of hybrid lenses through which laser beams of the forwardly deflecting optical system of optical scanning device shown in FIG. 2 [passes] pass, respectively;

On page 9, 4th full paragraph (lines 16-19):

FIG. 7 is a schematic view for explaining [a second embodiment of hybrid lenses through which arbitrary beam] one of hybrid lenses through which laser beams of the forwardly deflecting optical system of the optical scanning device shown in FIG. 2 [passes] pass, respectively;

On page 21, Table 2, 3rd & 4th headings:

Lens surface No. [4] 3 (incidence plane of lens 30b) coefficient

Lens surface No. [1] 4 (ejection plane of lens 30b) coefficient

On page 22, 2nd full paragraph (lines 6-16):

If [two image-forming lenses] an imaging lens set 30 that has two image-forming lenses 30a and 30b are included in the post deflecting optical system 21 under a condition that intervals between the plurality of beams are maintained constantly in all

the scanning regions, wave aberration can not be corrected with a conventional toric lens or symmetry rotation aspheric surface having symmetry axis of rotation, and the image surface beam diameter can not be stopped down to 100 μm or smaller. This fact was found by simulation and therefore, the lens of the post deflecting optical system shown in tables 1 and 2 has the above-described shape.

On page 22, 3rd full paragraph (lines 17-25):

Since lens surfaces (incident surface of 30a, incident surface of 30b, leaving surface of 30a and leaving surface of 30b) of each of the two image-forming [lenses 30a and 30b] <u>(the imaging lens set 30)</u> are formed into the shape having no symmetry axis of rotation, it is possible to stop down the image surface beam diameter to about 50 μm while constantly maintaining the intervals between the plurality of beams in all the scanning regions.

On page 24, 3rd full paragraph (lines 23-26):

Here, the forwardly deflecting optical system 7Y will be explained as a representative of laser beam 3Ya ejected from the first yellow laser 3Ya to the polygonal mirror unit 5<u>, as shown in FIG. 4</u>.

On page 25, 2nd full paragraph (lines 9-13):

A half mirror 12Y is inserted in between the [infinite] <u>finite</u> focal lens 9Ya and the hybrid lens 11Y at a predetermined angle with respective to an optical axis between the infinite focal lens 9Ya and the hybrid lens 11Y.

On page 25, 3rd full paragraph (lines 14-27):

On a surface opposite from a surface which the laser beam Lya enters from the first yellow laser 3Ya on the half mirror 12Y, a laser beam Lyb from the second yellow laser 3Yb disposed such that a predetermined beam distance can be provided in the sub-scanning direction with respect to the laser beam Lya from the first yellow laser 3Ya enters at a predetermined beam distance in the sub-scanning direction with respect to the laser beam Lya from the first yellow laser 3Ya. [An infinite] <u>A finite</u> local lens 9Yb and an aperture 10Yb are disposed between the second yellow laser 3Yb and the

half mirror 12Y for converging the laser beam Lyb from the second yellow laser 3Yb to a predetermined value.

On page 26, 2nd full paragraph (lines 7-11):

As the [infinite] finite focal lenses 9 (Y, M, C and B) a and 9 (Y, M, C and B) b, an aspherical glass lens or a single lens comprising an aspherical glass lens and UV cure plastic aspheric lens laminated on the aspherical glass lens can be utilized.

On page 26, 3rd full paragraph (lines 12-19):

[The] As shown in Fig. 4, the hybrid lens 11Y is formed with a PMMA lens 17Y and a glass cylinder lens 19Y. The hybrid lens 11Y has a structure in which the lens 17Y and the cylinder lens 19Y has an air layer between the leaving surface of the lens 17Y and the cylinder lens 19Y, and a portion of the lens through which light does not pass is provided with a portion in which both the lenses are in contact with each other, shown in Fig. 5.

On page 26, 4th full paragraph (lines 20-24):

The post deflecting optical system 21 including the imaging lens set has the positive power in the sub-scanning direction, and if a temperature rises, index of refraction is reduced and the lens is expanded and thus, the power (symbol is + (plus)) is reduced.

On the paragraph spanning pages 27-28 (page 27, line 26 to page 28, line 11):

However, if the air layer is inserted [in between unlike the conventional technique,] as shown in Fig. 5, a region which is in contact with the glass lens and has the glass shape and a region having the original plastic lens shape are generated in a region through which the light of plastic passes as shown in FIG. [4] 5. If there is a slight deviation in shape of both the surfaces, the focus position is deviated between the region having the glass shape and the region of the plastic lens, which makes it difficult to obtain optical beam shape at one location. [A first embodiment (corresponding to claim 5) having a structure for solving this problem is shown in FIG.

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5.] The first embodiment has a structure for solving the above problem, as shown in Fig. 6.

On page 28, 1st full paragraph (lines 12-15):

As shown in [FIG. 5] FIG. 6, the plastic lens [17Y] 17 is made of material such as PMMA (polymethyl methacrylate). The glass cylinder lens [19Y] 19 is made of material such as SF6.

On page 28, 2nd full paragraph (lines 16-23):

When the plastic lens 17 of the hybrid cylinder lens 11 [is used a plastic lens having] has a surface of negative power in the sub-scanning direction, and the plastic lens 17 and the glass cylinder lens 19 are assembled, a space portion is formed while sandwiching one convex surface of [the glass lens, and a second resin lens has a projection abutting in the one convex surface] the glass cylinder lens 19, and the plastic lens 17 has at least two of the projection portions 17a abutting in the convex surface.

On page 29, 2nd full paragraph (lines 13-23):

[FIG. 6] FIG. 7 is for explaining another embodiment of the optical scanning device of the present invention. The [image-forming lens] hybrid cylinder lens 11 has a includes a one side convex glass cylinder having curvature of substantially the same absolute value as that of the resin lens having negative power surface and having positive power in the sub-scanning direction. The resin lens and the glass cylinder lens have a space portion sandwiching the one side convex surface, and have a substantially constant thickness therebetween, and a deformable sheet is inserted.

On page 29, 3rd full paragraph (lines 24-26):

In the example shown in [FIG. 6] FIG. 7, a Mylar sheet which is a plastic sheet 18 having 0.05 mm thickness is sandwiched.

Marked up rewritten claim:

4. (Amended) The optical scanning device according to claim 2, wherein [the resin lens of] said second lens <u>includes a resin lens</u> having a surface whose radius of curvature in said second direction is varied along said first direction.

New claims:

8. (New) An optical scanning device comprising:

a light source;

a forwardly deflecting optical set including a first lens for providing light beams from said light source with a predetermined characteristic, and a second lens for converging said light beams from said first lens in a first direction;

a polygonal mirror unit for deflecting the light beams from said forwardly deflecting optical set into a second direction substantially perpendicular to said first direction; and

a third lens for forming the light beams deflected by said polygonal mirror unit as an image onto a predetermined image surface at a substantially equal speed,

wherein said second lens includes a resin lens and a glass cylinder lens made of glass having a positive power in said first direction and wherein the resin lens of said second lens having a surface whose radius of curvature in said second direction is varied along said first direction.

9. (New) An optical scanning device comprising:

a light source;

a forwardly deflecting optical set including a first lens for providing light beams from said light source with a predetermined characteristic, and a second lens for converging said light beams from said first lens in a first direction;

a polygonal mirror unit for deflecting the light beams from said forwardly deflecting optical set into a second direction substantially perpendicular to said first direction; and

a third lens for forming the light beams deflected by said polygonal mirror unit as an image onto a predetermined image surface at a substantially equal speed,

wherein said second lens includes a resin lens and a glass cylinder lens made of glass having a positive power in said first direction and wherein the resin lens of said second lens having a surface whose radius of curvature in said first direction is varied along said second direction.

10. (New) An optical scanning device comprising:

a light source;

a forwardly deflecting optical set including a first lens for providing light beams from said light source with a predetermined characteristic, and a second lens for converging said light beams from said first lens in a first direction;

a polygonal mirror unit for deflecting the light beams from said forwardly deflecting optical set into a second direction substantially perpendicular to said first direction; and

a third lens for forming the light beams deflected by said polygonal mirror unit as an image onto a predetermined image surface at a substantially equal speed,

wherein said second lens includes a resin lens and a glass cylinder lens made of glass having a positive power in said first direction and wherein the resin lens of said second lens having a surface whose radius of curvature in said second direction is varied along said second direction.